

CLAIMS

1. A multimode optical fiber that favors lower order modes, the fiber comprising:

a core having a longitudinal optical axis and incorporating radially dependent amounts of dopant materials to provide a desired refractive index profile and a desired Raman gain coefficient profile that favors lower order modes and discriminates against higher order modes; and

a cladding region surrounding the core and having a refractive index different from that of the core material;

wherein light launched into an end of the fiber is subject to higher Raman gain along the optical axis, which promotes lower order modes and discriminates against higher order modes.

2. A multimode optical fiber as defined in claim 1, wherein:

the core incorporates radially dependent amounts of selected transparent oxides, to provide radially dependent control of the refractive index; and radially dependent amounts of a dopant that affects the Raman gain coefficient, to provide a radially dependent Raman gain coefficient profile; and

the refractive index and the Raman gain coefficient have their highest values along the optical axis of the fiber.

3. A multimode optical fiber as defined in claim 2, wherein the dopant that affects the Raman gain coefficient is germanium oxide.

4. A multimode optical fiber as defined in claim 2, wherein the refractive index profile and the Raman gain coefficient profile both have a generally parabolic shape with a peak coinciding with the optical axis of the fiber.

5. A multimode optical fiber as defined in claim 2, wherein dopant concentrations are selected to provide a measure of independent control over the refractive index profile and the Raman gain coefficient profile.

6. A Raman laser oscillator, comprising:

a multimode optical fiber that favors lower order modes, the fiber comprising a core having a longitudinal optical axis and incorporating radially dependent amounts of dopant materials to provide a desired refractive index profile and a desired Raman gain coefficient profile that favors lower order modes and discriminates against higher order modes, and a cladding region surrounding the core and having a refractive index different from that of the core material;

a diode laser array providing pump power to the laser oscillator;

means for launching the pump power into the fiber; and

reflective means defining a laser cavity encompassing the fiber;

wherein light launched into the fiber is subject to higher Raman gain along the optical axis, which promotes lower order modes and discriminates against higher order modes.

7. A Raman laser oscillator as defined in claim 6, wherein the refractive index profile and the Raman gain coefficient profile both have a generally parabolic shape with a peak coinciding with the optical axis of the fiber.

8. A Raman laser oscillator as defined in claim 6, wherein the reflective means comprises a highly reflective mirror positioned at one end of the fiber and a partially transmitting mirror at the other end of the fiber.

9. A Raman laser oscillator as defined in claim 6, wherein:

the reflective means comprises a highly reflective mirror at one end of the fiber and a partially transmitting mirror; and

the oscillator further comprises optical means for receiving light emitted from the other end of the fiber and transmitting a generally collimated beam to the partially transmitting mirror.

10. A Raman laser oscillator as defined in claim 9, wherein the optical means comprises multiple lenses and a pinhole filter.

11. A method of generating a diffraction limited high brightness laser beam in a multimode fiber, the method comprising:

providing a multimode fiber having a core with radially dependent amounts of at least one dopant that provides a refractive index profile and a Raman gain index profile with maxima coinciding with the optical axis of the fiber;

generating high brightness pump power in a laser diode array;

launching the pump power into one end of the multimode fiber;

in the fiber, favoring the lowest order mode by providing maximum Raman gain along the optical axis, and discriminating against higher order modes;

providing a laser cavity that encompasses the multimode fiber; and

outputting a diffraction limited high brightness beam from the laser cavity.